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10/799,101	03/12/2004	Lothar Benedict Erhard Josef Moeller	Moeller 20-10	7666

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EXAMINER	
LIU, LI	
ART UNIT	**PAPER NUMBER**
2613	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/21/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/799,101	Applicant(s) MOELLER ET AL.	
	Examiner Li Liu	Art Unit 2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. ______.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *03/12/2004*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 03/12/2004 is being considered by the examiner.

Specification

2. Claims 2, 5 and 8 objected to because of the following informalities:

1). Page 12, claim 2, line2, "optical bandpass filtered" should be changed to "optical bandpass filter".

2). Page 12, claim 5, line2, "optical bandpass filtered" should be changed to "optical bandpass filter".

3). Page 13, claim 8, line2, "optical bandpass filtered" should be changed to "optical bandpass filter".

Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zheng (X. Zheng et al: "Receiver Optimization for 40-Gb/s Optical Duobinary Signal", IEEE Photonics Technology Letters, Vol. 13, No. 7, July 2001, page 744-746) in view of

Hayee et al (M. Hayee: "NRZ Versus RZ in 10-40-Gb/s Dispersion-Managed WDM Transmission Systems", IEEE Photonics Technology Letters, Vol. 11, No. 8, August 1999, page 991-993) and Lee et al (US 2004/0101314).

1). With regard to claim 1, Zheng et al discloses an optical receiver (Figure 1, OF, O/E and EF, page 744 right column, II. Simulation Model) for receiving a duobinary optical signal at a bit rate B bits per second, the receiver comprising:

an optical bandpass filter (OF in Figure 1) responsive to the duobinary optical signal for filtering the signal within a passband of B Hz (Figure 1, 40-Gb/s duobinary system, OF 40GHz in Figure 2b, page 745 right column second paragraph: a narrow optical filter can improve sensitivity effectively; page 746, right column, first paragraph: the optimum bandwidth of the optical filter is around 40 GHz); and

an optical detector (O/E in Figure 1) for recovering data from the filtered duobinary optical signal.

But Zheng et al does not disclose that the duobinary optical signal is an **RZ**-duobinary optical signal.

It is well known that the NRZ signal can tolerate more chromatic **dispersion** than RZ. However, as admitted by the applicant, the prior art has demonstrated that the RZ-duobinary signal is more tolerant to fiber **nonlinearities**. Hayee et al, in the same field of endeavor, discloses that the RZ is less affected by nonlinearity than NRZ (Figure 4(a)-(c)), but RZ system is more susceptible to dispersion than NRZ duo to RZ high modulation bandwidth. And Lee et al discloses an RZ-dubinary transmitter (Figures 1 and 3).

Zheng et al uses a narrow optical filter at the receiver side to improve the dispersion tolerance (Figure 4) and filter the ASE noise; and under the optimum conditions, the sensitivity of optical duobinary signal can be improved greatly (page 746, IV. CONCLUSION). Hayee et al shows RZ modulation has better tolerance to **nonlinearity,** and Lee et teaches an RZ-duobinary transmitter, and Zheng et al demonstrate that an narrow optical filter improve the **dispersion** tolerance. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the RZ-duobinary modulation as taught by Hayee et al and Lee et al to the system of Zheng et al so that both nonlinearity tolerance and dispersion tolerance can be improved, and also the ASE noise can be reduced by the narrow optical filter.

2). With regard to claim 2, Zheng in view of Hayee et al and Lee et al discloses all of the subject matter as applied to claim 1 above. And Zheng et al further discloses wherein a center frequency of the optical bandpass filter can be detuned from a center frequency of the RZ-duobinary optical signal by an amount less than or equal to $\pm$ 0.1x B (Zheng et al discloses that the optimum bandwidth of the optical filter is around 40 GHz; when detuned by 4 GHz, one side of the filter is about 16 GHz from the carrier and another side is about 24 GHz from the carrier. The applicant uses a 2^{nd}-order super-Gaussian filter and Zheng et al uses a third-order Bessel filter, both filters have relatively flat top, therefore, the performance of the detuned filter is equivalent to a filter with a bandwidth between 32 GHz and 48 GHz; based on Figures 2b and 4, optical filters with different bandwidth are tested, as the optical filter >= 32 GHz and <= 48 GHz, the sensitivity is still around -33 dBm$\pm$ 0.3 dBm, the benefits is substantial).

3). With regard to claim 3, Zheng et al discloses an optical receiver (Figure 1, OF, O/E and EF, page 744 right column, II. Simulation Model) for receiving an duobinary optical signal at a bit rate B bits per second, the receiver comprising:

an optical bandpass filter (OF in Figure 1) responsive to the duobinary optical signal for filtering the signal within a passband having a bandwidth greater than or equal to 0.7 x B Hz (30 GHz in Figure 2b) and less than or equal to 1.3 x B Hz (Figures 2b and 4, optical filters with different bandwidth are tested, as the optical filter > 30 GHz and < 50 GHz, the sensitivity is still around -33 dBm $\pm$ 0.5 dBm, the benefits is still substantial compared with the OF 100 GHz); and

an optical detector (O/E in Figure 1) for recovering data from the filtered duobinary optical signal.

But Zheng et al does not disclose that the duobinary optical signal is an **RZ**-duobinary optical signal.

It is well known that the NRZ signal can tolerate more chromatic **dispersion** than RZ. However, as admitted by the applicant, the prior art has demonstrated that the RZ-duobinary signal is more tolerant to fiber **nonlinearities**. Hayee et al, in the same field of endeavor, discloses that the RZ is less affected by nonlinearity than NRZ (Figure 4(a)-(c)), but RZ systems is more susceptible to dispersion than NRZ duo to RZ high modulation bandwidth. And Lee et al discloses an RZ-dubinary transmitter (Figures 1 and 3).

Zheng et al uses a narrow optical filter at the receiver side to improve the dispersion tolerance (Figure 4) and filter the ASE noise; and under the optimum

conditions, the sensitivity of optical duobinary signal can be improved greatly (page 746, IV. CONCLUSION). Hayee et al shows RZ modulation has better tolerance to **nonlinearity,** and Lee et teaches an RZ-duobinary transmitter, and Zheng et al demonstrate that an narrow optical filter improve the **dispersion** tolerance. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the RZ-duobinary modulation as taught by Hayee et al and Lee et al to the system of Zheng et al so that both nonlinearity tolerance and dispersion tolerance can be improved, and also the ASE noise can be reduced by the narrow optical filter.

4). With regard to claim 4, Zheng et al discloses a method for receiving a duobinary optical signal (Figure 1, OF, O/E and EF, page 744 right column, II. Simulation Model) having a data bit rate of B bits per second, the method comprising the steps of:

bandpass filtering (OF in Figure 1) the signal through a passband substantially equal to B Hz (Figure 1, 40-Gb/s duobinary system, OF 40GHz in Figure 2b, page 745 right column second paragraph: a narrow optical filter can improve sensitivity effectively, page 746, right column, first paragraph: the optimum bandwidth of the optical filter is around 40 GHz); and

recovering data (O/E in Figure 1) from the filtered signal, wherein the signal conforms to an duobinary signaling format.

But Zheng et al does not disclose that the duobinary signal format is an **RZ-** duobinary signaling format.

It is well known that the NRZ signal can tolerate more chromatic **dispersion** than RZ. However, as admitted by the applicant, the prior art has demonstrated that the RZ-duobinary signal is more tolerant to fiber **nonlinearities**. Hayee et al, in the same field of endeavor, discloses that the RZ is less affected by nonlinearity than NRZ (Figure 4(a)-(c)), but RZ systems is more susceptible to dispersion than NRZ duo to RZ high modulation bandwidth. And Lee et al discloses an RZ-dubinary transmitter (Figures 1 and 3).

Zheng et al uses a narrow optical filter at the receiver side to improve the dispersion tolerance (Figure 4) and filter the ASE noise; and under the optimum conditions, the sensitivity of optical duobinary signal can be improved greatly (page 746, IV. CONCLUSION). Hayee et al shows RZ modulation has better tolerance to **nonlinearity,** and Lee et teaches an RZ-duobinary transmitter, and Zheng et al demonstrate that an narrow optical filter improve the **dispersion** tolerance. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the RZ-duobinary modulation as taught by Hayee et al and Lee et al to the system of Zheng et al so that both nonlinearity tolerance and dispersion tolerance can be improved, and also the ASE noise can be reduced by the narrow optical filter.

5). With regard to claim 5, Zheng in view of Hayee et al and Lee et al discloses all of the subject matter as applied to claim 4 above. And Zheng et al further discloses wherein a center frequency of the optical bandpass filter can be detuned from a center frequency of the RZ-duobinary optical signal by an amount less than or equal to ± 0.1x B (Zheng et al discloses that the optimum bandwidth of the optical filter is around 40

GHz; when detuned by 4 GHz, one side of the filter is about 16 GHz from the carrier and another side is about 24 GHz from the carrier. The applicant uses a 2nd-order super-Gaussian filter and Zheng et al uses a third-order Bessel filter, both filters have relatively flat top, therefore, the performance of the detuned filter is equivalent to the a filter with a bandwidth between 32 GHz and 48 GHz; based on Figures 2b and 4, optical filters with different bandwidth are tested, as the optical filter >= 32 GHz and <= 48 GHz, the sensitivity is still around -33 dBm $\pm$ 0.3 dBm, the benefits is substantial).

6). With regard to claim 6, Zheng et al discloses a method for receiving a duobinary optical signal having a data bit rate of B bits per second, the method comprising the steps of:

bandpass filtering (OF in Figure 1) the signal through a passband having a bandwidth greater than or equal to 0.7.times.B Hz and less than or equal to 1.3.times.B Hz (Figures 2b and 4, optical filters with different bandwidth are tested, as the optical filter > 30 GHz and < 50 GHz, the sensitivity is still around -33 dBm $\pm$ 0.5 dBm, the benefits is still substantial compared with the OF 100 GHz); and

recovering data (O/E in Figure 1) from the filtered signal, wherein the signal conforms to a duobinary signaling format.

But Zheng et al does not disclose that the duobinary signaling format is an **RZ-** duobinary signaling format.

It is well known that the NRZ signal can tolerate more chromatic **dispersion** than RZ. However, as admitted by the applicant, the prior art has demonstrated that the RZ-duobinary signal is more tolerant to fiber **nonlinearities**. Hayee et al, in the same field

of endeavor, discloses that the RZ is less affected by nonlinearity than NRZ (Figure 4(a)-(c)), but RZ systems is more susceptible to dispersion than NRZ duo to RZ high modulation bandwidth. And Lee et al discloses an RZ-dubinary transmitter (Figures 1 and 3).

Zheng et al uses a narrow optical filter at the receiver side to improve the dispersion tolerance (Figure 4) and filter the ASE noise; and under the optimum conditions, the sensitivity of optical duobinary signal can be improved greatly (page 746, IV. CONCLUSION). Hayee et al shows RZ modulation has better tolerance to **nonlinearity,** and Lee et teaches an RZ-duobinary transmitter, and Zheng et al demonstrate that an narrow optical filter improve the **dispersion** tolerance. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the RZ-duobinary modulation as taught by Hayee et al and Lee et al to the system of Zheng et al so that both nonlinearity tolerance and dispersion tolerance can be improved, and also the ASE noise can be reduced by the narrow optical filter.

7). With regard to claim 7, Zheng et al discloses an optical transmission system comprising:

an optical transmitter (Figure 1, page 744 right column II. Simulation Model) for generating a duobinary optical signal at a bit rate B bits per second;

an optical transmission medium (Figure 1, NZ-DSF fiber) coupled to the optical transmitter for supporting propagation the duobinary optical signal;

an optical bandpass filter (OF in Figure 1) coupled to an output of the optical transmission medium and being responsive to the duobinary optical signal for filtering

the signal within a passband of B Hz (Figure 1, 40-Gb/s duobinary system, OF 40GHz in Figure 2b, page 745 right column second paragraph: a narrow optical filter can improve sensitivity effectively; page 746, right column, first paragraph: the optimum bandwidth of the optical filter is around 40 GHz); and

an optical detector (O/E in Figure 1) for recovering data from the filtered RZ-duobinary optical signal.

But Zheng et al does not disclose that the duobinary optical signal is an **RZ**-duobinary optical signal.

It is well known that the NRZ signal can tolerate more chromatic **dispersion** than RZ. However, as admitted by the applicant, the prior art has demonstrated that the RZ-duobinary signal is more tolerant to fiber **nonlinearities**. Hayee et al, in the same field of endeavor, discloses that the RZ is less affected by nonlinearity than NRZ (Figure 4(a)-(c)), but RZ systems is more susceptible to dispersion than NRZ duo to RZ high modulation bandwidth. And Lee et al discloses an RZ-dubinary transmitter (Figures 1 and 3).

Zheng et al uses a narrow optical filter at the receiver side to improve the dispersion tolerance (Figure 4) and filter the ASE noise; and under the optimum conditions, the sensitivity of optical duobinary signal can be improved greatly (page 746, IV. CONCLUSION). Hayee et al shows RZ modulation has better tolerance to **nonlinearity,** and Lee et teaches an RZ-duobinary transmitter, and Zheng et al demonstrate that an narrow optical filter improve the **dispersion** tolerance. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was

made to combine the RZ-duobinary modulation as taught by Hayee et al and Lee et al to the system of Zheng et al so that both nonlinearity tolerance and dispersion tolerance can be improved, and also the ASE noise can be reduced by the narrow optical filter.

8). With regard to claim 8, Zheng in view of Hayee et al and Lee et al discloses all of the subject matter as applied to claim 7 above. And Zheng et al further discloses wherein a center frequency of the optical bandpass filter can be detuned from a center frequency of the RZ-duobinary optical signal by an amount less than or equal to ± 0.1x B (Zheng et al discloses that the optimum bandwidth of the optical filter is around 40 GHz; when detuned by 4 GHz, one side of the filter is about 16 GHz from the carrier and another side is about 24 GHz from the carrier. The applicant uses a 2^{nd}-order super-Gaussian filter and Zheng et al uses a third-order Bessel filter, both filters have relatively flat top, therefore, the performance of the detuned filter is equivalent to the a filter with a bandwidth between 32 GHz and 48 GHz; based on Figures 2b and 4, optical filters with different bandwidth are tested, as the optical filter >= 32 GHz and <= 48 GHz, the sensitivity is still around -33 dBm $\pm$ 0.3 dBm, the benefits is substantial).

9). With regard to claim 9, Zheng et al discloses an optical transmission system comprising:

an optical transmitter (Figure 1, page 744 right column II. Simulation Model) for generating a duobinary optical signal at a bit rate B bits per second;

an optical transmission medium (Figure 1, NZ-DSF fiber) coupled to the optical transmitter for supporting propagation the duobinary optical signal;

an optical bandpass filter (OF in Figure 1) coupled to an output of the optical transmission medium and being responsive to the duobinary optical signal for filtering the signal within a passband having a bandwidth greater than or equal to 0.7xB Hz and less than or equal to 1.3 x B Hz (Figures 2b and 4, optical filters with different bandwidth are tested, as the optical filter > 30 GHz and < 50 GHz, the sensitivity is still around -33 dBm $\pm$ 0.5 dBm, the benefits is still substantial compared with the OF 100 GHz); and

an optical detector (O/E in Figure 1) for recovering data from the filtered duobinary optical signal.

But Zheng et al does not disclose that the duobinary optical signal is an **RZ**-duobinary optical signal.

It is well known that the NRZ signal can tolerate more chromatic **dispersion** than RZ. However, as admitted by the applicant, the prior art has demonstrated that the RZ-duobinary signal is more tolerant to fiber **nonlinearities**. Hayee et al, in the same field of endeavor, discloses that the RZ is less affected by nonlinearity than NRZ (Figure 4(a)-(c)), but RZ systems is more susceptible to dispersion than NRZ duo to RZ high modulation bandwidth. And Lee et al discloses an RZ-dubinary transmitter (Figures 1 and 3).

Zheng et al uses a narrow optical filter at the receiver side to improve the dispersion tolerance (Figure 4) and filter the ASE noise; and under the optimum conditions, the sensitivity of optical duobinary signal can be improved greatly (page 746, IV. CONCLUSION). Hayee et al shows RZ modulation has better tolerance to **nonlinearity,** and Lee et teaches an RZ-duobinary transmitter, and Zheng et al

demonstrate that an narrow optical filter improve the **dispersion** tolerance. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the RZ-duobinary modulation as taught by Hayee et al and Lee et al to the system of Zheng et al so that both nonlinearity tolerance and dispersion tolerance can be improved, and also the ASE noise can be reduced by the narrow optical filter.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Wei et al (X. Wei: "Nonlinearity tolerance of RZ-AMI format in 42.7 Gbit/s long-haul transmission over standard SMF Spans", ELECTRONICS LETTERS, October 2, 2003, Vol. 39, No. 20, page 1459-1461).

Lyubomirsky (I. Lyubomirsky: "Experimental Demonstration of an Optimized Optical RZ-Duobinary Transmission System", IEEE Photonics Technology Letters, Vol. 17, No. 12, December 2005, page 2757-2759).

Miyamoto et al (US 2003/0002121) discloses an RZ-duobinary system with an optical filter at the receiver.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Li Liu whose telephone number is (571)270-1084. The examiner can normally be reached on Mon-Fri, 8:00 am - 5:30 pm, alternating Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Li Liu
November 28, 2006

KENNETH VANDERPUYE
SUPERVISORY PATENT EXAMINER